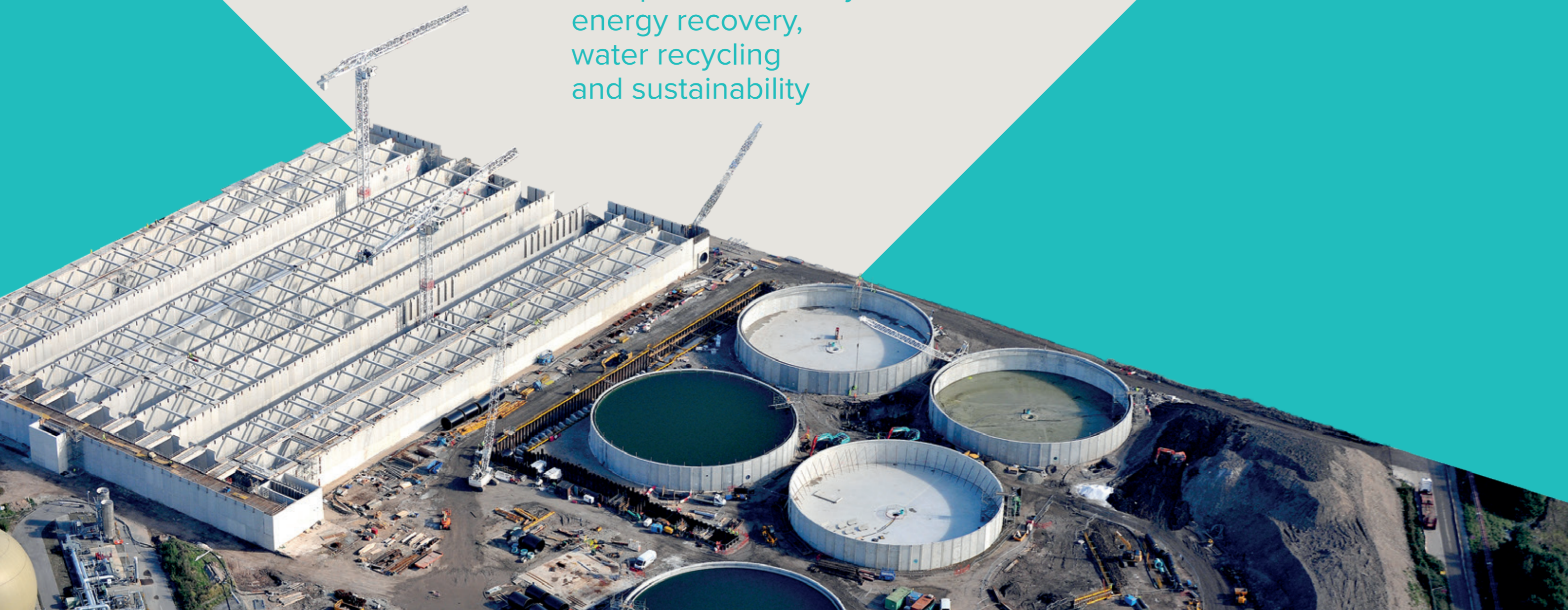


Smarter ways to treat wastewater

Innovative solutions
to improve efficiency,
energy recovery,
water recycling
and sustainability





Working towards a cleaner, better world

What price can be placed on economic development, safeguarding public health, improving the quality of life and protecting our environment?

How we manage wastewater plays a vital role in all of these outcomes, and with population growth and increasing urbanisation, the demand for sustainable wastewater treatment and reuse is greater than ever.

Asset owners and operators must minimise adverse environmental impacts and offset costs by extracting the maximum value from biosolids and other resources in our wastewater.

Furthermore, they need to increase the resilience of assets against climate change, comply with ever-higher regulatory standards, and maintain systems and facilities despite severe financial constraints.

In developing economies, greater access to clean water and effective sanitation are vital for alleviating poverty, reducing inequality and meeting the UN's Sustainable Development Goals.

The cost of modern, efficient wastewater treatment and reuse infrastructure is quantifiable; the value of the wider social and economic benefits it can bring is priceless.

This shapes our approach to wastewater treatment and reuse: we work collaboratively with clients to find the most sustainable, cost-effective solutions to their needs; at the same time we never forget our responsibility to the people who should ultimately benefit from what we design and deliver.



Helping you meet your objectives

Our solutions for the collection, treatment, disposal and reuse of wastewater combine decades of experience with innovative thinking.

Solving problems

Fresh thinking and an impartial view on the best way forward are of immense value at every stage of the project cycle, from feasibility studies to project delivery.

We're an employee-owned company and that independence really does provide us with the freedom to see and do things differently. We constantly stretch our thinking to seek out innovative solutions to solve the complex problems facing the wastewater treatment industry.

Through our global reach we accrue knowledge and best practice, giving all our clients – wherever in the world they are based – access to the full breadth and depth of our expertise and 80 years of experience.

We not only collaborate with clients but also work closely with others in their supply chains, harnessing our collective skills and ingenuity to forge delivery models that provide end-to-end service and support.

Technical know-how

There's little in the wastewater sector we haven't done. What that means for our clients and partners is the best solution for each challenge, optimised every time, and with innovation where it offers advantage. Our teams have extensive knowledge of biological nutrient removal, including process modelling, and are skilled in advanced aspects of sludge processing, including anaerobic digestion, associated side-stream treatment systems, heat recovery and energy generation.

We manage all aspects of odour control, from initial optimisation of processes to minimise odour generated, to the installation of appropriate technology for the removal of odour.

From affordable sanitation in poor urban and rural environments, to major automated wastewater treatment and water reclamation plants in advanced economies, we've got a record to be proud of.

Help wherever you need it

Advisory, engineering design and operational support covering:

- All treatment stages: preliminary, primary, secondary, tertiary and disinfection
- Municipal, rural and industrial settings
- Environmental audits and assessments
- Physical, chemical and biological treatment processes
- Water reuse/recycling
- Energy efficiency
- Wastewater solids handling, energy and nutrient recovery, biosolids management and sustainable reuse or disposal

Bespoke solutions

Proper definition of a project's requirements involves gaining an in-depth understanding of site-specific challenges, the discharge, disposal and reuse strategy, the political and business environment, and the needs of stakeholders and end users.

Once we have assessed a project on an individual level, we work with clients to help meet their objectives by:

- Developing tailor-made, practical, cost-effective solutions that meet the precise requirements of each project and benefit every stakeholder.
- Utilising specially developed in-house tools to optimise the performance of existing infrastructure, and the latest building information modelling (BIM) software systems to optimise the design and operation of new assets.
- Reducing spend through innovative approaches based on robust engineering and advanced design and construction techniques such as design for manufacture and assembly (DfMA).
- Designing energy recovery schemes and adopting a carbon-based approach to projects that set mandatory targets for embodied carbon and emission reductions.
- Unlocking new sources of investment to get projects off the ground and bringing them to financial close.



Clean thinking on wastewater treatment

Finding solutions that are good for business, good for the end user, and good for our world.

Increasing treatment plant efficiency

Our overriding goal is to help clients develop innovative new ways of treating, disposing and reusing wastewater that will save energy, cut costs and reduce waste – efficiencies that will transfer directly to their bottom line.

We have developed sophisticated tools that focus on system performance at every stage of the treatment lifecycle: from pumping, aeration, clarifier capacity and dewatering performance through to digestion, water reuse and recycling, and energy recovery.

These applications have enabled owners and operators to realise the full capacity of their plants, which can be as much as 50% greater than nominal capacity, with consequent operational cost savings of up to 30%. They also allow informed decisions on when to maintain equipment based on cost-benefit analysis and carbon reduction.

Asset management

Our teams work with our clients to challenge the levels of redundancy and maintenance at their plants, increasing their understanding of when and how to maintain equipment to deliver optimum efficiency, value for money and investment return.

We offer support in achieving ISO 55000, the international standard for asset management, and have developed systems that give our clients a better understanding of their customers' needs, helping them to refine their business processes and balance the risks of service failure.

We see asset management as a way of helping infrastructure owners and operators achieve their strategic objectives, adding value and optimising performance for the benefit of customers, end users and their balance sheets while they do so.

Innovation and research

Our experts collaborate with clients on the development of low-carbon, energy-efficient project delivery, and we undertake research on treatment-related issues from operating practices to cutting-edge technologies.

Research projects have included sustainable sludge management for small treatment plants, maximising the value of biogas, and examining the balance – using net environmental benefit analysis – between tighter effluent discharge standards, improvements in receiving river quality and increased carbon emissions.

We have helped companies seeking to commercialise innovative sludge treatment technologies – providing technical, cost and market intelligence analyses as well as assistance in launching demonstration projects. This work has included hydrothermal carbonisation of sludge to produce 'bio-coal' and the use of electric field technologies to enhance sludge digestion.

Cut carbon, cut costs

If you cut carbon, you will cut costs. We will help you to understand and benchmark your carbon footprint and then develop carbon-reduction strategies, covering changes in operational practices and the adoption of energy efficiency schemes and green technologies – bringing savings in both carbon and cost.

We can identify and implement a range of measures to enable you to reduce carbon emissions on several levels: carbon emissions intensity (for example, per m³ of wastewater treated), embodied carbon, operating carbon and overall carbon emissions.

Protecting the environment

Environmental considerations need to be built into project planning from the earliest stages, so that they make a positive contribution to informed decisions on the design of projects. Our teams prioritise environmental issues at all stages of the project cycle, from initial environmental evaluations at the prefeasibility and feasibility levels, through full environmental impact assessments to environmental audits and monitoring during project construction and operation.

Industrial wastewater treatment

We take a comprehensive approach to solving the wastewater challenges that our industrial clients face rather than just offering an 'end of pipe' solution. This support covers pollution prevention, waste minimisation, best management practices, water reuse assessments, regulatory assistance, energy production and, of course, the design, commissioning and operational assistance of energy-efficient wastewater treatment systems.

How we can help you

Our services cover all aspects of wastewater treatment including:

- Technical advisory services in the form of due diligence of existing infrastructure and future requirements for sector reform and privatisation
- Data capture and problem definition
- Capacity, condition and efficiency assessments
- Feasibility studies, concept design, planning and approvals
- Detailed treatment process engineering, design and procurement assistance
- Construction management and support
- Commissioning and operational services
- Asset management services (rehabilitation studies, resilience modelling)
- Optimisation (including laboratory-based characterisation techniques, process simulation/hydraulic modelling)
- Carbon management assistance

10 ways our expertise in wastewater treatment can help you:

1.

Plan investment wisely

Our models and methodologies can help you plan wastewater infrastructure to ensure new assets are reliable, cost-effective and sustainable, delivering optimum value for money. We can also make your investments work harder through value engineering and whole-life cost analysis.

2.

Get the right fit

Every client's needs are different. We develop solutions in response to each individual situation, matching technologies with budgets and operational requirements. Sometimes the right solution will be off-the-shelf. Other times it will be unique – we have pioneered techniques such as treatability trials to better understand wastewater characteristics so that we can develop customised treatment solutions. Either way, we will have evaluated the options and made a carefully considered decision.

3.

Resource recovery

Extracting the maximum value from wastewater and biosolids is essential to offset operational costs and increase sustainability. We have implemented many schemes around the world that recover energy or nutrients for beneficial use.

4.

Better understanding of risks

We know what it takes to get a project over the line both in terms of financing and risk management. Beyond the capital delivery phase, we also understand the environmental and health risks associated with lack of, or poorly performing, wastewater infrastructure, and the reputational and commercial harm it can do.

5.

Added value

At the start of every project we search for the opportunity to add value in our designs. We interrogate the project goals to achieve the most cost-effective outcome, taking into account both capital and whole-life costs.

6.

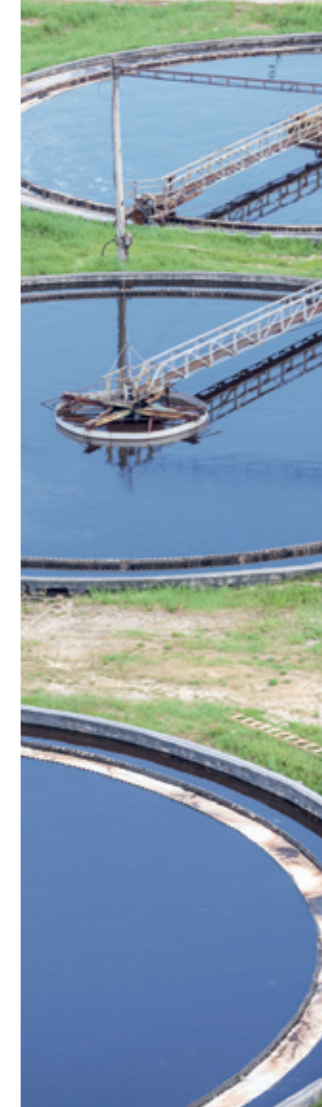
Smart technology

Data harvesting, analysis, augmented decision-making and automated control systems can extend the working life of existing assets by making them more adaptable, more resilient, and achieve better utilisation of capacity. We have developed our own suite of smart tools that allow carbon management, optimisation, performance baselining against other plants globally, and asset management based on robust data.

7.

Build efficiently and safely

Building information modelling (BIM) brings major efficiencies to the design process. We've been stretching the boundaries of BIM since it first emerged and are responsible for some of the industry's BIM exemplar projects. Areas where we're leading its development include the integration of analysis and modelling tools, and the use of BIM to advance safer, more efficient delivery through design for manufacture and assembly (DfMA).



8.

Cut carbon, cut costs

Proved on project after project, cutting capital and operational carbon delivers bottom-line financial savings – major clients have cut costs by over 20%. We co-wrote the UK infrastructure industry standard for carbon management, PAS 2080, and developed the first BIM-enabled carbon calculator. Work with us to cut the carbon footprint and cost of your assets.

9.

Innovative software and tools

Our Moata tool enables the operators of complex infrastructure to create 'smart' networks and systems. It makes sense of complex data, showing where efficiencies can be achieved to maximise capacity, minimise upgrade costs and reduce operational expenditure. We are leaders in the development and use of virtual and augmented reality technologies to provide increased productivity and improved safety both in construction and operation of assets.

10.

Find more funding

We are the world's leading technical advisor on infrastructure finance – we've got the trophies to prove it! It's a position built on skill in identifying and mobilising finance and funding, de-risking investment and managing procurement.



Innovating with biosolids to cut costs and carbon

Project
Anglian Water Biosolids Programme

Location
East Anglia, UK

Client
Anglian Water Services

Expertise
Strategy development, feasibility studies, outline designs, detailed civil designs, site supervision, environmental impact assessments, environmental permit applications, technical support, programme management

Opportunity
Anglian Water serves over 6M wastewater customers and its wastewater treatment plants generate nearly 180,000t of treated sewage sludge (dry solids) annually. The company was looking for ways to produce an enhanced treated biosolids product, improving the quality of sludge supplied to local farmers, while at the same time reducing the total volume of biosolids and cutting costs and carbon through increased renewable energy generation.

Solution
Working with our partners, we undertook a detailed evaluation process and recommended two enhanced digestion solutions: biological hydrolysis and thermal hydrolysis. The most suitable process was used at each site to pretreat the sludge in order to pasteurise it as well as increase the level of volatile matter destruction in the anaerobic digesters. These processes bring a number of benefits including significantly increased biogas energy production, reduced quantities of sludge solids to be recycled, improved sludge quality (near 100% pathogen removal) and a more stable sludge product with low odour. Biogas from the digesters is used in combined heat and power engines to generate electricity and heat for the on-site sludge and wastewater treatment processes.

Outcome
Implementing enhanced digestion processes enabled Anglian Water to take advantage of spare digester capacity and consolidate its sludge treatment activities at four sites instead of the five originally planned. **This provided greater overall treatment capacity – increased from the baseline target by 30% – for the same capital cost but with an opex saving of £3M per year.** The combination of eliminating the older lime treatment process, improved dewatering and converting more sewage sludge to biogas – making the four facilities self-sufficient in renewable energy – **has reduced the total volume of biosolids being transferred off site by 40%.**

Plant expanded by 40% within same footprint

Project
Rotorua Wastewater Treatment Plant

Location
North Island, New Zealand

Client
Rotorua Lakes Council

Expertise
Detailed process and mechanical design, procurement documentation, construction supervision, commissioning and operations support



Opportunity
The wastewater plant in Rotorua processes the effluent produced by around 70,000 people and is critical to preserving the natural beauty of the area – a popular tourist destination with spectacular geysers and volcanos. The district council wanted to expand the site to meet the needs of more than 100,000 people but the land available to build on was severely limited due to active geothermal ground conditions. What's more, volcanic activity meant the air is laden with hydrogen sulphide, which adds to corrosion problems normally associated with wastewater.

Solution
We spotted an opportunity to retrofit an obsolete tank with cutting-edge technology, which delivered the additional 40% capacity required while complying with stringent effluent quality standards but without expanding the site's footprint with new structures. At the heart of this plan was an advanced membrane bioreactor (MBR), which passes wastewater through a semi-permeable membrane to filter out particulate material, reducing the size of the aeration chambers required and eliminating the need for settlement tanks. The volcanic atmosphere required particular consideration when specifying construction materials and electrical components; our solutions included installing air purification systems in buildings that house electrical switchgear, and coating field cables with tin to avoid corrosion.

Outcome
The Rotorua wastewater plant can now treat an average daily flow of 30,000m³ per day, enough to meet the needs of all residents living within its enlarged catchment. It **provides the best quality wastewater discharged in the country and is the first in New Zealand to use hollow fibre membranes coupled to MBR technology on a large scale.** Our innovative solution required a little more investment at the design stage, but it was recovered later in the project when the solution **cut capital costs from NZ\$15M to NZ\$10M.**

Upgraded plant will meet future effluent limits

Project

Caldwell Wastewater Treatment Plant Upgrade

Location

Caldwell, New Jersey, USA

Client

Borough of Caldwell

Expertise

Study, design, permitting, financial assistance, construction administration

Opportunity

The Borough of Caldwell's wastewater treatment plant relied on equipment that was up to 50 years old and either at or near the end of its useful working life. Refurbishment and upgrade works were badly needed to improve operational efficiency and comply with new and anticipated regulations governing effluent limits. Funding was available from New Jersey's State Revolving Fund (SRF).

Solution

We evaluated and designed upgrades to the plant using BioWin modelling software, and prepared the required applications and submittals, from the planning stages through to construction, to secure a low-interest loan from the SRF. New equipment included effluent pumps, odour control system, chemical feed facilities for phosphorus removal and a UV disinfection system to replace the chlorination/dechlorination system. As well as constructing a new aerobic digester and associated equipment, existing anaerobic digesters were converted to thickened sludge holding tanks and a second rotary drum sludge thickener installed. Modifications to the existing oxidation ditches included replacing the surface aerators with larger ones, and installing a dissolved oxygen monitoring and control system to optimise aeration performance through the simultaneous nitrification-denitrification process.

Outcome

The 8000 citizens of Caldwell benefit from a modernised 17,000m³/d tertiary wastewater treatment plant that **complies with an anticipated future effluent limit for phosphorus and meets a new 10mg/l effluent limit for nitrate.** Part of the upgrade included the installation of a solar photovoltaic system, based on our specification, which will generate 225kW of electricity, **increasing the plant's energy efficiency and sustainability.**



225kW

Solar power generation capacity installed

Widening access to sanitation in Jakarta

Opportunity

Only 2-3% of Jakarta's residents live in homes connected to a sewer system. The Jakarta Sewerage Programme will extend sewerage to around 80% of the city by 2050, requiring around US\$7bn of capital investment. The government is seeking to leverage private investment to pay for new urban infrastructure. We conducted a scoping study to improve the quality and availability of data and identify potential revenue streams to attract investors to back the programme.

Solution

We held intensive consultations with stakeholders, working with them to review the project's masterplan and detailed engineering designs, particularly in relation to land/footprint constraints for locating 14 wastewater treatment plants in a heavily built-up city. We weighed the advantages of public private partnership (PPP) procurement models over traditional procurement and evaluated the suitability of different wastewater treatment processes. [To help prioritise investment, we used GIS mapping to identify and quantify the potential revenues that could be generated](#) through provision of piped sewerage services in each zone of the programme area.

Outcome

Our study highlighted gaps in documentation, especially in relation to financing, risk assessments, and detailed engineering design. It showed how timely, relevant and robust data could be generated in the future to support fast-track decision making by stakeholders and investors. [We identified steps the Government of Indonesia could take to unlock new sources of private finance.](#) The ultimate aim of our recommendations is to accelerate the sewerage programme, hastening improved health outcomes and economic prosperity for millions of Jakarta's residents.



Project

Jakarta Sewerage Scoping Study

Location

Jakarta, Indonesia

Client

Department of Foreign Affairs and Trade, Australia

Expertise

Wastewater/sewer systems analysis, stakeholder consultation, technical and financial advisory

US\$7bn

Required investment in critical infrastructure – our study will help secure private sector funding



Unlocking investment in Amman's infrastructure



75%

Level of energy efficiency achieved through advanced recovery systems

Project

As Samra Wastewater Treatment Plant

Location

As Samra, Jordan

Client

Arab Bank

Expertise

Lenders' technical advisory services

Opportunity

The rapid increase in the population of Amman placed increased pressure on wastewater infrastructure, one of the impacts of which was the discharge of untreated sewage into watercourses. Jordan's Ministry of Water and Irrigation turned to the private sector for support and the delivery of a modern full-scale wastewater treatment system, involving leading-edge technologies. Affordability was a real issue so innovative financing was needed to realise the scheme.

Solution

The facility, with a throughput capacity of nearly 360,000m³ per day, provides full wastewater treatment and biosolids management, and achieves 75% energy recovery. Delivered through a design, build, finance and operate (DBFO) contract, the Samra Project Company will operate the plant for 20 years with full responsibility for asset management and driving down whole-life costs. We provided technical and commercial due diligence to the lenders to achieve successful financial close of this complex project, which involved viability gap funding, followed by construction assurance and operation monitoring services.

Outcome

The project has delivered multiple environmental benefits by reducing odours and pollution at the treatment plant, tanker reception centre and satellite pumping stations. Treated water is being used by local farmers with the remainder safely discharged into the Zarqa River. The power requirements of intensive wastewater treatment have been minimised by installing hydropower turbines and generators that run on gas recovered from treated biosolids. This public private partnership DBFO model has attracted the interest of local stakeholders and international funders as a template for delivering similar infrastructure projects in Jordan and worldwide.

Plan improves monitoring of critical assets

Opportunity

The Gippsland Water Factory treats 35,000m³/d of wastewater from nine towns in central Gippsland and serves the needs of 50,000 residential customers as well as local businesses, including the largest pulp and paper mill in Australia. It comprises two wastewater treatment plants – one domestic, one industrial – sharing common infrastructure and utilising membrane bioreactor technology. Gippsland Water needed an asset lifecycle management strategy to achieve operational efficiencies and deliver consistent levels of service in accordance with its customer charter.

Solution

With Gippsland Water we developed a comprehensive asset management plan (AMP). Due to the plant's complexity, we split development of the AMP into eight packages, with each package representing one major process area. A criticality assessment identified assets that would lead to a plant shutdown or compromise safety if they failed. A site condition assessment identified assets 'at risk' based on an evaluation of their remaining working life. Risk profiles showed Gippsland Water which capital renewal projects to prioritise.

Outcome

Our AMP enabled Gippsland Water to monitor asset performance more effectively, giving greater understanding of the plant's capacity and where to prioritise capital renewal and maintenance investment. In addition, the AMP paves the way for a transition from preventative to predictive maintenance. As part of this project, we carried out optimisation works to reduce or remove the need for chemical dosing, cutting costs and supporting Gippsland Water's goal to manage the impacts of its operations on the environment in a sensitive and sustainable manner.

Project

Gippsland Water Factory
Asset Management Plan

Location

Victoria, Australia

Client

Gippsland Water

Expertise

Model development, optimisation,
asset management

US\$300M

Our asset management strategy has optimised future investments



Works stays operational during major upgrade



Project

Davyhulme Modernisation

Location

Manchester, UK

Client

United Utilities

Expertise

Bid design, detailed civil, structural, hydraulic and geotechnical design

Opportunity

Davyhulme Wastewater Treatment Works is the largest in the north-west of England, serving a population of more than 1.2M people. It has iconic status in the sector as the site where modern wastewater treatment, specifically the activated sludge process, was invented over 100 years ago. As part of United Utilities' drive to ensure 100% availability of its critical assets, Davyhulme received significant investment to improve efficiency, increase levels of automation and optimise treatment processes. A key challenge of the project was maintaining the operational activities of the works while updating the existing facilities.

Solution

The £150M upgrade to the existing 750,000m³/d plant consists of a new inlet works which will forward 8.2m³/s to full treatment, with part of the old inlet works converted to screen dedicated stormwater flows of up to 22m³/s. A new activated sludge process stream will treat up to 60% of the total flow to full treatment and will consist of six primary settlement tanks, 10 aeration lanes and 10 final settlement tanks. Sludge works improvements include new dewatering equipment and buffer storage. Design for manufacture and assembly (DfMA) replaced many conventional construction activities, enabling approximately 30% of the 10,000 components to be fabricated off site.

Outcome

DfMA was crucial to the project's success by delivering estimated material savings of 15%, and a **three-month programme reduction worth £1M**. Less time spent working on site **reduced or avoided many safety hazards associated with construction** and minimised disruption, ensuring the existing plant remained fully operational. The modernisation programme has involved significant remediation of previously abandoned land and will improve the quality of treated effluent entering the Manchester Ship Canal.

15%

Estimated material savings through implementation of DfMA



Project
Dairy Wastewater Management

Location
Republic of Ireland

Client
Glanbia

Expertise
Treatment process assessments, feasibility studies, outline design, detailed design, procurement, operational support, permit assistance

Upgrades ensure dairy plants comply with standards

Opportunity

Glanbia, a global nutrition company, has major production facilities in Ireland, USA, UK, Germany and China. The wastewater treatment plants at three of its dairy production sites in Ireland required upgrades to maintain Integrated Pollution Prevention and Control (IPPC) licences and meet local authority discharge requirements.

Solution

We designed an upgrade to the wastewater treatment plant at a yogurt manufacturing facility to handle the removal of fats, oils and grease, nitrogen and phosphorus, as well as provide improved balancing facilities. For another production facility, which produces milk and whey powder, we made recommendations on treating wastewater streams with increased organic and nutrient loadings. At a liquid milk facility, we conducted a review of existing wastewater treatment plant and made recommendations on works required to ensure compliance with current and anticipated regulations.

Outcome

Our expertise in industrial wastewater treatment has helped Glanbia **meet its regulatory obligations and reduce risk, allowing the company to continue to grow and focus on its core business** of manufacturing performance nutrition products for its customers around the globe. Improving effluent management will also strengthen Glanbia's green credentials in the marketplace by reducing the environmental impacts of its operations.

Two plants become one

Opportunity

The wastewater treatment plants at Hook and Johnston, located in a rural area of Wales, required substantial upgrading to allow for population growth. Ageing equipment and facilities needed to be refurbished or replaced to reduce the risk of leakage and adverse impacts on the marine environment. We undertook a feasibility study for Dwr Cymru Welsh Water (DCWW) to find ways of increasing the capacity of the plants and improving their operational and environmental performance.

Solution

Our solution avoided the need to build two new treatment plants by decommissioning the plant at Johnston and redirecting the wastewater to a new wastewater treatment facility at Hook. We designed a transfer pumping station, 6km pipeline and the new plant, which has a flow to full treatment capacity of 5000m³/day and includes a sequencing batch reactor system and sludge storage and handling. We maximised the use of design for manufacture and assembly (DfMA), and specified standard products from our digital component catalogue for many of the process items – for example, sludge tanks and duct draw pits – to make design and construction programme savings.

Outcome

The new works cater for increased demand in the catchment, and have improved the quality of discharges into receiving watercourses. Using DfMA and standard precast concrete products **saved approximately £200,000 in capex costs**. Consolidating two sites into one has cut operational costs significantly and reduced overall energy consumption, leading to an **opex saving of approximately £20,000 per year**. A collaborative working relationship with DCWW and environmental regulator, National Resources Wales, ensured delivery of the project on time and on budget.



Project
Hook and Johnston Wastewater Treatment Plants

Location
Haverfordwest, Pembrokeshire, Wales, UK

Client
Dwr Cymru Welsh Water

Expertise
Feasibility assessment, whole-life cost analysis, detailed design, procurement and construction

Opening opportunities with connected thinking.

Talk to us: watertreatment@mottmac.com

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